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Proceedings of a Workshop on a Decision Support Tool for Stocking of Atlantic Whitefish

Compte rendu d'un atelier sur un outil de soutien décisionnel à l'empoissonnement en corégone atlantique

24 November 2004
Coastal Inn
Dartmouth, NS

Le 24 novembre 2004
Coastal Inn
Dartmouth (N.-É.)

Robert O'Boyle
Meeting Chairperson

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April 2005 / avril 2005

Canada

Foreword

The purpose of these proceedings is to archive the activities and discussions of the meeting, including research recommendations, uncertainties, and to provide a place to formally archive official minority opinions. As such, interpretations and opinions presented in this report may be factually incorrect or mis-leading, but are included to record as faithfully as possible what transpired at the meeting. No statements are to be taken as reflecting the consensus of the meeting unless they are clearly identified as such. Moreover, additional information and further review may result in a change of decision where tentative agreement had been reached.

Avant-propos

Le présent compte rendu fait état des activités et des discussions qui ont eu lieu à la réunion, notamment en ce qui concerne les recommandations de recherche et les incertitudes; il sert aussi à consigner en bonne et due forme les opinions minoritaires officielles. Les interprétations et opinions qui y sont présentées peuvent être incorrectes sur le plan des faits ou trompeuses, mais elles sont intégrées au document pour que celui-ci reflète le plus fidèlement possible ce qui s'est dit à la réunion. Aucune déclaration ne doit être considérée comme une expression du consensus des participants, sauf s'il est clairement indiqué qu'elle l'est effectivement. En outre, des renseignements supplémentaires et un plus ample examen peuvent avoir pour effet de modifier une décision qui avait fait l'objet d'un accord préliminaire.

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ABSTRACT

Atlantic whitefish (*Coregonus huntsmani*) is designated as "endangered" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and is listed on Schedule 1 of the *Species at Risk Act* (SARA).

The Atlantic whitefish Conservation and Recovery Team (AWCRT) is developing a Recovery Strategy to ensure the survival and ultimately the recovery of this species which is wholly contingent on the continued viability of a population now confined to three semi-natural lakes within the Petite Rivière system. One recovery measure is the stocking of Atlantic whitefish into habitats that are conducive to their survival, but may be additional to their current range. This recovery measure raises several issues regarding the potential impact of a newly introduced species into the ecosystem.

This workshop was held to investigate the best approach and information requirements necessary to develop a decision support framework to guide the selection of new habitats for the recovery of this species. It was determined that 1) any decision support framework should conform to the National Code on Introductions and Transfers of Aquatic Organisms (Appendix V) and, 2) the process already incorporated into the National Code to direct licensed introductions under Section 56 of the Fisheries General Regulations could be adapted to address the issue of Atlantic whitefish stocking. A draft decision support tool (DST) was completed at the workshop (Appendix VI).

RÉSUMÉ

Le corégone atlantique (*Coregonus huntsmani*) a été désigné comme étant une espèce « en voie de disparition » par le Comité sur la situation des espèces en péril au Canada (COSEPAC) et il figure sur la liste de l'annexe 1 de la *Loi sur les espèces en péril* (LEP).

L'équipe responsable de la conservation et du rétablissement du corégone atlantique est un train d'élaborer un Programme de rétablissement destiné à assurer la survie et finalement le rétablissement de cette espèce, dépendant entièrement du maintien de la viabilité d'une population maintenant confinée à trois lacs semi-naturels du réseau hydrographique de la Petite Rivière. Une des mesures de rétablissement est l'empoissonnement en corégone atlantique d'habitats se prêtant à la survie de ce poisson, mais qui ne font peut-être pas partie de son aire de distribution actuelle. Cette mesure de rétablissement soulève diverses questions concernant l'incidence possible de l'introduction d'une nouvelle espèce sur l'écosystème.

L'atelier dont il est rendu compte ici avait pour but de déterminer quelle est la meilleure méthode à adopter et quels sont les renseignements dont on a besoin pour élaborer un cadre de soutien décisionnel permettant de guider le choix de nouveaux habitats pour le rétablissement du corégone atlantique. Il a permis de déterminer que 1) tout cadre de soutien décisionnel devrait être conforme au Code national sur l'introduction et le transfert d'organismes aquatiques (annexe V) et que 2) les modalités déjà comprises dans le Code national concernant les introductions autorisées aux termes de l'article 56 du *Règlement de pêche (dispositions générales)* pourraient être adaptées à l'empoissonnement en corégone atlantique. Une ébauche d'outil de soutien décisionnel a été établie à l'atelier (annexe VI).

INTRODUCTION

This report provides a record of both the discussions regarding the release of Atlantic whitefish into a water body outside of its current habitat and the draft decision support tool (DST) that was developed at the session.

The workshop took place in Dartmouth on November 24, 2004 and was chaired by R. O'Boyle from Maritimes Science Branch, Fisheries and Oceans. The meeting was attended by 20 participants representing the Atlantic whitefish Conservation and Recovery Team (AWCRT), the provincial department of Agriculture and Fisheries, Fisheries and Oceans sectors of socioeconomics, species at risk, science, habitat management, and fisheries management, peer review invitees, and universities (Appendix I). The letter of invitation and agenda are presented in Appendices II and III respectively.

As outlined in the terms of reference for the workshop (Appendix IV), the objective of the meeting was to investigate the need for and utility of a DST to guide selection of new habitats for the survival and recovery of the species. In support of this objective, three presentations were considered: Discussion points on development of criteria to direct Atlantic whitefish stocking activities (R. Bradford), Introductions of Atlantic whitefish (*Coregonus huntsmani*) to a watercourse in Nova Scotia (S. O'Neil), and Tools and approaches to environmental decision making (T. Worcester).

The products of the meeting are these proceedings, and the draft DST for site selection of Atlantic whitefish introductions which is attached as Appendix VI.

The Chair opened the meeting, introduced participants, described the format of the meeting and coordinated discussions. The proceedings notes were kept by the rapporteur, K. Robichaud-LeBlanc. The authors delivered their presentations during which questions of clarification were addressed. Participants were then given the opportunity to comment on the content of the presentations. Following the general discussions regarding the development and application of a DST, participants assembled a draft list of questions for each information requirement for further formulation into a DST.

STOCKING PROPOSAL

Discussion Points On Development of Criteria
to Direct Atlantic Whitefish Stocking Activities

R.G. Bradford
DFO, Science Branch, Dartmouth, N.S.

Presentation Highlights

Atlantic whitefish (*Coregonus huntsmani*), once known from two river drainages in Nova Scotia, and to exhibit both land-locked and anadromous life-history variants, now persist as a single, largely land-locked population in the Petite Rivière. Repatriation of the extirpated anadromous run on the Tusket-Annis rivers is a recovery objective which will require direct human intervention: stocking. However, it is uncertain that repatriation to the Tusket-Annis will be successful. As well, the long-term status of the Petite Rivière population is now questionable owing to the recent illegal introduction of smallmouth bass into the river drainage. Stocking activities could therefore conceivably proceed as either a planned recovery action or as a rescue action to ensure survival of the species.

Prohibitions against harm to Atlantic whitefish under Sections 32 and 33 of the *Species At Risk Act* have potential to affect activities that normally contribute to enjoyment of private property and/or recreational or commercial use of a water body. Presumably stocking to meet recovery objectives would proceed after having fulfilled 'due diligence' (e.g., risk assessments, address data deficiencies, etc.). Rescue efforts may or may not have the benefit of accrued information to support actions at the time action is necessary. Therefore, any decision support tool developed to assist with identification of candidate stocking sites will need to consider socio-economic as well as ecological factors. An even cursory assessment of issues associated with Atlantic whitefish introductions reveals the magnitude of socio-economic, ecological, and institutional factors that will require assessment prior to action.

- Society
  - Receptiveness
  - Education/Outreach/Awareness
  - Long-term Viability
    - Protection from Invasive Species
    - Human alteration of recipient habitat
- Ecosystem
  - Compatible Fish Assemblage
  - Buffer from introduced species
    - site (in- and out-migration)
    - assemblage
  - Habitat
    - water quality
    - forage base

  - Containment of introduced huntsmani
- Economy
  - Enjoyment of property
  - Docks
  - Boats
  - Lawns
  - Angling
  - Commercial fisheries

Selection of sites wherein interaction with the public at large is minimal would appear to be a pre-condition for consideration of waterbodies as candidate recipient sites, if not for recovery actions then at least under conditions where stocking proceeds as a rescue action.

Discussion

- Author clarified that the term "private lands" referred specifically to instances where one or few owners controlled land use and/or access to a waterbody.

- Differences in objectives (conditions) was clarified
  1. Recovery Objective: Given known distribution, Tusket River would be given first consideration if trying to establish a stock beyond the boundaries of the Petite Rivière drainage.

  2. Conservation Objective: Relates to Atlantic whitefish Allowable Harm discussion on other opportunities – i.e. introduce to other lakes (additional sites beyond current range of species)

  3. Rescue Objective: In response to a catastrophic event. Need determination that the species is worth saving and consideration of a risk assessment with uncertainty of effect.

- The author presented three tables relating to scoping out the magnitude of issues. Points of clarification were addressed concerning the information requirements to direct stocking as a recovery action or as a survival action (which includes stocking as an emergency response to a catastrophic event).

  - It was clarified that the code *D* meant access to donor site needed.
  - Comment was made that any kind of transplant will affect human activities on that body of water, so will require an assessment of harm.
  - Comment was made that a decision needs to be made this spring on what to do with fish currently in the biodiversity facility.
  - It was suggested that it might be appropriate to add another row in the table for institutional considerations that don't fit in to current categories, but another dimension we might want to capture.
  - There was some concern with the column headings. Comment was made that recovery is the goal but before recovery comes preservation (survival) of the species. Rescue initiatives should begin now. Might as

well put those two things together. Any review of literature (smallmouth bass) suggest very imprudent not to put fish into safe habitat. No need to separate these two issues out.

- The issue of conservation and rescue is a reality and would require acting quickly and on short notice. Question was raised about how much evidence is needed to say now is the time. There is a predator, smallmouth bass, and a credible body of scientific literature that indicates a likelihood of negative interaction between smallmouth bass and Atlantic whitefish. Prudence would lead one in the direction of assuming the worst. An argument was made that lake whitefish and smallmouth do very well together, but it was clarified that the life history of Atlantic whitefish differs from that of lake whitefish. Consensus from workshop participants was to establish fish somewhere else so that we don't lose them.

- There was some discussion on the need for a conceptual objective. The question was raised about defining what is meant by the term 'rescue'. It was noted that there was no phrase in the document that states the objective. The formal statement of the recovery objective during the Allowable Harm assessment was reiterated. Author clarified that the recovery objective as stands now is repatriation to the Tusket and promotion of anadromy on the Petite. The recovery objective from the Recovery Strategy was quoted and the need for a clear objective with reference points was argued. It was indicated that in those situations you have time to think and plan, but not in the event of a catastrophic event.

- Some discussion revolved around the development of a stocking criteria, in current situation or more generally. If case is general, then we must speak in generalities without going into specifics of species. It was indicated that others will be looking at the Atlantic whitefish decision support tool as an example, thus it has broader implications beyond whitefish.

- There was some discussion on the current availability of fish at the biodiversity facility. Question was asked that if this is the tool to use are we going to deal with product available now. The need for careful planning was pointed out, giving time to make decisions and make case that these are the best fish for stocking. There was mention of the Atlantic salmon situation (stocking in other systems).

- The chair made the point that we are scoping out issues and developing a checklist of things to look for. Comment was made that there is scope for rapid action given the current situation. Even under this tool there is still room for action, in absence of information.

INTRODUCTIONS AND TRANSFERS PROCESS

Introduction of Atlantic Whitefish (*Coregonus huntsmani*)
to a Watercourse in Nova Scotia

S. F. O'Neil
DFO, Science Branch, Dartmouth, N.S.

Presentation Highlights

Atlantic whitefish are indigenous to Nova Scotia but confined to a single watershed, the Petite Rivière, near Bridgewater. The species is listed as "endangered" and the Recovery Plan includes as an objective the introduction of captive reared Atlantic whitefish to another water body to lower the risk of extinction of the species.

Adult whitefish were collected in 2001, 2002 and 2003 and bred in captivity to produce juveniles for release according to the recovery team's schedule. Planning for that proposed release in 2005 involves several steps, one of which is the acquisition of a license (Section 56 Fisheries General Regulations) for the introduction. The Fisheries General Regulations states:

> Section 56: The Minister may issue a license if (*a*) the release or transfer of the fish would be in keeping with the proper management and control of fisheries;
>
> (*b*) the fish do not have any disease or disease agent that may be harmful to the protection and conservation of fish; and
>
> (*c*) the release or transfer of the fish will not have an adverse effect on the stock size of fish or the genetic characteristics of fish or fish stocks.

The National Code on Introductions and Transfers (NCIT) is the tool used to guide the process of reviewing requests for introductions of an aquatic species. The NCIT provides a description of the introductions and transfers review process and a template (Appendix III in the National Code) for preparing a request to introduce a species or stock into a water body where it is not present. The format and types of information to be included in such an application include:

Introduction:

- Name, characteristics;
- History of use of species;
- Rationale for proposed introduction;
- Area of introduction including map;
- Number of animals proposed for release and time period;
- Source stock including relevant genetics.

Life history information:

- Native range and this range extension if appropriate and history of introductions;
- Factors that limit range including physiological tolerances and growth rate;
- Habitat, reproductive, migratory and feeding behaviours as appropriate;
- Diseases and parasites known and relevance.

Interactions with native species:
- Habitat overlap with existing species in proposed introduction area;
- Feeding and predation considerations;
- Hybridization risks or other genetic issues;
- Spawning behaviour impacts on local stocks/species.

Receiving environment and contiguous watershed:
- Physical and water quality characteristics of proposed recipient watershed;
- Biota present (invertebrates, plants, fish);
- Critical habitat – relevance and overlap on same for existing species/stocks;
- Restrictions on movement if any.

Proposed monitoring:
- Describe follow-up actions to track introduced species/stock.

Precautions and Management Plan:
- Management of the stock including information about disease, fellow travelers, and access limitations;
- Description of actions to limit escape of species into neighbouring water bodies;
- Impacts on access to other species (i.e., SARA).

According to the National Code, a proposed request will be subject to a risk assessment. The Introductions and Transfers Committee will use the information provided to consider the risks of disease and ecological and genetic impacts.

The Introductions and Transfers Committee in Nova Scotia usually meets quarterly depending on the frequency of requests. An application received in early 2005 could be reviewed and a decision rendered by March or April if the information is complete.

Discussion

- Chair reiterated understanding that for DFO to take 4-5000 Atlantic whitefish at the Mersey Biodiversity Facility and introduce them into a system we must go through the introductions and transfers process presented. It was also clarified that the information presented is based on a National template and that all questions are published in the National Code [Appendix V].

- Comment was made that if introducing fish into the Petite watershed, an application must go to the I&T Committee because there is a genetic concern, but may not need formal assessment.

- Chair clarified that a submission would come from a proponent on behalf of the recovery team. The Introductions and Transfers (I&T) committee fills out a risk assessment (often without proponent being there), therefore it would be prudent for proponent to look at what's in code.

- It was agreed that the National Code on Introductions and Transfers provides an adequate basis upon which to develop a Decision support tool to guide the selection of new habitats for the survival and recovery of this species.

- There was discussion about knowledge gaps and how they might cause an application for Atlantic whitefish to not come out as a low risk assessment. Tusket would be worst because of compounding environmental and other effects (gaspereau fishery, pH, smallmouth bass, etc.). Fisheries management pointed out that chances of catching whitefish in introduced system are low, therefore there might not be a need to shut down fisheries.

- There was some discussion as to how the Decision support tool would fit with the National Code. The tool is to address the why, when and where. The I&T Committee assesses the submission and they are judge of the proposal.

- Comment was made to look at what the National Code covers and that might be the focus. Presenter clarified that the I&T Committee recognizes special circumstances. It was suggested to build what's in Code into the decision support tool if an application is to be successful.

- Question was asked about what is the most important objective of application. Approval of the license so work towards system to get license approved. Look at sites and criteria to get that license. Participant suggested adding another column to meet objectives of recovery team – success of introductions.

- The meeting discussed the need to ensure that the required elements of an I&T submission be accommodated within the Decision Support Framework.

- The subject of public consultation was discussed, before or after approval by I&T committee and by whom? The proponent, on behalf of the recovery team would have to conduct the public consultation. It was pointed out that although the I&T review process does not show a requirement for consultation, an I&T committee decision would be smoother if there was public support. Therefore consultations should occur prior to the submission of an application.

- Process was broken down into four steps
    1 - Present working group decides on the "where"
    2 - Recovery team puts proposal together
    3 - Consultations (on all options)
    4 - Application to I&T committee on 'best' option(s)

INTEGRATED MANAGEMENT, DECISION SUPPORT TOOLS AND RISK MANAGEMENT APPROACHES

Tools and Approaches for Environmental Decision Making

T. Worcester
DFO, Science Branch, Dartmouth, N.S.

Presentation Highlights

This presentation started with an overview of DFO's Ecosystem Objectives Framework, Risk Assessment approaches (including Spatial Risk Assessment) and an example of a Decision Support System used to evaluate finfish aquaculture sitting proposals in the Maritimes Region. The overview was followed by a demonstration of how these various tools might be integrated into an Environmental Risk Management framework that could be used to evaluate the risk of introducing Atlantic whitefish into previously unoccupied habitats.

Using DFO's Ecosystem Objectives as a guide, risks to the environment due to a species introduction could be evaluated in terms of genetic risks, risks to species diversity, risks to community health and structure, and risks to habitat. Socio-economic and institutional (management) risks would also have to be considered. Once risks had been identified, a qualitative approach could be used to establish the likelihood and severity of these effects under different scenarios (e.g. different receiving environment or different source stocks). Each scenario could then be evaluated, first according to whether or not it was an acceptable option (i.e. does it exceed some predetermined risk threshold) and then in some relative manner to other possible options. Once a particular option had been selected, management action would be expected to reflect the level of risk associated with that option as well as the level of certainty associated with the risk determination.

To make comparison of various whitefish introduction options easier, it might be possible to put together a semi-automated decision-support tool. The practicality of developing a decision-support tool would depend upon the quality of information available to use as input and the extent of its anticipated usefulness. For example, if it would only be used to evaluate two sites, it might not be worthwhile. If it could be used for other purposes or was needed to evaluate many different whitefish introduction scenarios, there may some benefit in pursuing this idea further.

Discussion

- The point was made that decisions informed by the decision support tool will depend on categories of risk assigned (high, medium or low). Chair asked if appendix III of the National Code could be used as the basis of the risk analysis tool.

- Comment was made that if we are not thinking of generalizing to other species, then better to just evaluate our five top sites, given our time frame.

The importance of a paper trail was pointed out. It was considered important to document our decision on the choice of five top sites.

- One of the objectives of the Atlantic whitefish Recovery Strategy recommends finding another location for these fish, but it doesn't say that it 'must happen'. Thought was that a transplant was best course of action. Chair reiterated the terms of reference for this meeting: to discuss the requirements of a decision support framework.

- Some exercise to identify risk can't be ignored. It was thought that it might be useful to work through some specific hypothetical examples with somewhat different constraints. Thought was that it might be prudent to walk through appendix III of National Code and under each specific question to develop the criteria that would be used to select options.

- It was agreed that it might be more efficient to flag issues of concern regarding site suitability then go back to framework and see where it fits. Further, social, economical and institutional (legal, monitoring) risks should be taken into consideration.

- Concern was raised about being here to understand process and define criteria, not to write application, but the importance of a paper trail and why we think this is a good idea was again raised. Chair indicated that this kind of sentiment could be fit in under question B5: What alternate strategies have been considered in order to meet objectives of the proposal? What are the implications of a "do nothing" option?

DISCUSSION ON REQUIREMENTS OF DECISION SUPPORT TOOL

The objective of the Decision support tool was discussed: to support an informed decision for site selection of Atlantic whitefish introductions and to feed into a secondary process (i.e. I&T application requirements). Requirement of the decision support tool began with the idea of grading an I&T proposal (Appendix IV) and seeing where issues would fit in. A list of potential questions was formulated for each I&T information requirement. Numbering below relates to questions from Appendix III of the National Code (Appendix IV).

Listed below are some of the issues raised relating to the questions in each section of the National Code.

A) Executive Summary

B) Introduction
  - B1-3) Required background information

  - B4) Describe the objectives and rationale for the proposed introduction.
    - Good place to capture sentiments of the objectives.

- Capture gaps. For example, framework doesn't address social and economical implications and impacts of the options.
- Capture issue of implications on existing fisheries.

- B5) What alternative strategies have been considered and implications of doing nothing
  - Suggestion to list alternatives was rejected.

- B6) What is the geographic area of the proposed introduction?
  - Is proposed area within historical range?
  - Is area secure from habitat destruction?
  - Is site in managed area?
  - Is site dedicated to other use?

- B8) Describe the source(s) of the stock and genetic stock.
  - Genetic implications would be incorporated here.

C) Life History Information of the species.
- Tombstone information. Nothing needed to be captured in section.

D) Interaction with Native Species.
- D1) Likelihood of survival and establishment in target area?
  - Discussion regarding definition of 'non-native' species as refers to watershed or region.
  - Chances of survival and reproduction in new system are low (opposite of what we want). Argument, they did colonize one lake on their own.

- D1b) Likelihood of escapement from target area.
  - Influenced by location.
  - Likelihood of unwelcome SARA issue.
  - Positive of negative consequences.
  - Impacts on native species. Other impacts.

- D2) Presence of vulnerable, threatened or endangered species
  - Issues?
  - Overlap with other endangered species (SAR species).
  - Overlap with provincially protected species.
  - Overlap with other species with conservation significance (dwarf smelt).
  - Overlap with non-native species (smallmouth bass, chain pickerel).
  - Compliance with recovery strategy of other species.
  - Overlap with special habitats (protected areas).

- D3) Potential for niche overlap (trophic interactions)
  - Spawning habitat interactions.
  - Residence overlap. Unknown.

- D4) Types and amounts of food available
  - Utilize information on current usage.
  - Availability or equivalence of forage with present area of occupancy.

- D5) Impacts of predation on receiving ecosystem
  - Predator/prey interactions.
  - Trophic interactions. No evidence.

- D6) Likelihood of ongoing survival and reproduction
  - Purpose of experiment (inferential information).
  - Rating of spawning and rearing viability.
  - Aggregation of previous 4 questions (summary).
  - High Likelihood of requirement for ongoing stocking.

- D7) Potential for hybridization with native species
  - Genetic impacts on native species (lake whitefish).
  - Presence of hatchery-source Atl. Whitefish?
  - Evidence of hybridization. No.
  - Opportunity for hybridization. Unknown.

- D7b) Potential for local extinction
  - No relevant.

- D8) Potential impacts on habitat or water quality
  - Habitat suitability.
  - Effect of environment on whitefish.

- D9) Potential effects of parasites and disease and fellow travelers on native stocks
  - Disease profile of receiving environment. Not an I&T requirement, but a recovery team concern that may be desirable to address.
  - Disease profile of whitefish. Are the whitefish to be stocked healthy? (i.e. compliance with Fisheries and Health Protection Regulations)

- D10) Impacts of previous introductions
  - Does this include range extension? Colonization.
  - Doesn't influence decision.

E) Receiving Environment and Contiguous Watershed

F) Monitoring
- F1) Plans for follow-up assessment
  - Ease of monitoring.

G) Precautions and Management Plan
- G1g) Other legislative requirements
  - Compliance with Atlantic whitefish Recovery Strategy.

- Section 73 authorizations under SARA. Sec. 56 FGRs.

- G2) Mitigation to prevent escapement and establishment in non-target recipient ecosystem
  - Objective is to promote recovery (protection of stock vs. anadromy).
  - Evaluate likelihood of containment.
  - Social/regulatory implications of containment.

- G3) Contingency plan in event of escapement
  - Nothing we can do.
  - Evaluate ease of recapture (unplanned scenarios).

H) Business Plan / Other
- Financial issues:
  - Economic viability of proposal.
  - Evaluate ease of implementation.
  - Cost of maintaining fish in hatchery population.

- Record of public consultation.

- Receptiveness of society.

I) References

The questions and issues discussed above from the I&T application were then restructured and condensed into a more straightforward approach to accommodate a decision support structure. Questions related to the rationale were grouped together, site requirement questions were moved upfront, background species information, design proposal variables, risk to species and risk to receiving environment separated out, socio-economic impacts ("show-stoppers") were grouped together. The need for a 'management considerations' section was discussed and incorporated to capture questions such as difficulty of monitoring, likelihood of partnering, compliance with the Act, etc. Appendix VI provides the template of the draft DST framework.

CONCLUDING REMARKS

The chair thanked the participants for their valuable participation and contribution. As stated at the start of the meeting, the discussion of the meeting will be drafted as proceedings (this document). The next step is to pull together a stocking technical committee and convene a second meeting to review and finalize the decision support tool, assign weights to the various elements and evaluate some concrete examples.

Appendix I: List of Participants

Participant	Affiliation	Telephone	E-mail
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Appendix II: Letter of Invitation

Fisheries and Oceans Pêches et Océans

20 October 2004

Dear Participant:

Re: Workshop on Decision Support Tool for Stocking of Atlantic Whitefish

A recovery team has been developing a strategy and action plan to ensure the survival of Atlantic Whitefish. One recovery measure listed in the current Atlantic Whitefish recovery strategy is the stocking of Atlantic Whitefish. A decision support tool is needed to guide selection of new habitats for the recovery of this species. This workshop will investigate the requirements of such a decision support tool.

We invite your participation in this workshop, which is scheduled for 24 November 2004 (Wednesday) and will **begin at 9:00AM and conclude at 4:00PM** in the Harbour Front Meeting Room at the Coastal Inn, Windmill Rd., Dartmouth.

Thank you for your consideration of this request. I would appreciate confirmation of your participation (either in person or via telephone) in this workshop to Lynn Cullen @ 902-426-4164.

Yours sincerely,

Robert O'Boyle
Associate Director of Science; RAP Co-ordinator

Appendix III: Agenda

Workshop on Decision Support Tool
For Stocking of Atlantic whitefish
Harbour Room, Coastal Inn
Dartmouth, N.S.
24 November 2004

9:00	Welcome and introductions (Chair B. O'Boyle)
9:15	Atlantic whitefish Stocking Proposal (R. Bradford)
10:00	Break
10:15	Introductions & Transfers Process (S. O'Neil)
11:00	Integrated Management, Decision Support Tools and Risk Management Approaches (T. Worcester)
12:00	Lunch
13:00	Discussion on Requirements of Decision Support Tool for Atlantic Whitefish
15:00	Break
15:15	Discussion (Cont'd)
16:30	Next Steps (development of DSS, funding, etc.)
17:00	Adjournment

Appendix IV: Terms of Reference

Background

Atlantic Whitefish has been designated as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and listed in Schedule 1 of the Canada's Species at Risk Act. A recovery team has been developing a strategy and action plan to ensure the survival of this species. One recovery measure is the stocking of Atlantic Whitefish in habitats that are conducive to their survival but may be additional to their native range. This raises issues on the potential impact of a newly introduced species into an ecosystem. A decision support tool is needed to guide selection of new habitats for the recovery of this species. This workshop will investigate the requirements of such a decision support tool.

Objectives

- To discuss the requirements of a decision support frameworks, including
    - Integrated Management Framework
    - Considerations of Risk

- To discuss decision frameworks used in other like situations, particularly
    - Aquaculture Decision support tool
    - Decision tool of Introductions and Transfer Committee

- To outline the requirements of a decision support system for Atlantic Whitefish, including criteria to judge impact on
    - Atlantic Whitefish
    - Ecosystem
    - Society
    - Economy

- To discuss the institutional consequences of an Atlantic Whitefish stocking program, particularly
    - COSEWIC listing Process
    - Legal Issues

Products
Proceedings of workshop
Research Document

Participation
DFO Science
DFO Fisheries Management
Provincial Government Representatives
External Reviewers

Appendix V. National Code on Introductions and Transfers of Aquatic Organisms

National Code on Introductions and Transfers of Aquatic Organisms
To be completed by proponent

Wherever possible, information is to be supported with references from the scientific literature, and notations to personal communications with scientific authorities and fisheries experts. Applications lacking detail may be returned to the proponent for additional material, resulting in a delay in assessing the proposal.

For some proposals, e.g., intraprovincial transfers or other routine introductions/transfers, the information requirement may be reduced significantly. The local Introductions and Transfers Committee should be consulted in such cases.

A) Executive Summary:

Provide a brief summary of the document including a description of the proposal, the potential impacts on native species and their habitats and mitigation steps to minimize the potential impacts on native species.

B) Introduction

1) Name (common and scientific [genus and species]) of the organism proposed for introduction or transfer.

2) Describe the characteristics, including distinguishing characteristics, of the organism. Include a scientific drawing or photograph.

3) Describe the history in aquaculture, enhancement or other introductions (if appropriate).

4) Describe the objectives and rationale for the proposed introduction, including an explanation as to why such an objective cannot be met through the utilization of an indigenous species.

5) What alternate strategies have been considered in order to meet the objectives of the proposal? What are the implications of a "do nothing" option?

6) What is the geographic area of the proposed introduction? Include a map.

7) Describe the numbers of organisms proposed for introduction (initially, ultimately). Can the project be broken down into different sub-components; if so, how many organisms are involved in each sub-component?

8) Describe the source(s) of the stock (facility) and genetic stock (if known).

C) Life History Information of the Species to be Introduced or Transferred - For Each Life History Stage

1) Describe the native range and range changes due to introductions.

2) Record where the species was introduced previously and describe the ecological effects on the environment of the receiving area (predator, prey, competitor, and/or structural/functional elements of the habitat).

3) What factors limit the species in its native range.

4) Describe the physiological tolerances (water quality, temperature, oxygen, and salinity) at each life history stage (early life history stages, adults, reproductive stages).

5) Describe the habitat preferences and tolerances for each life history stage.

6) Describe the reproductive biology.

7) Describe the migratory behavior.

8) Describe the food preferences for each life history stage.

9) Describe the growth rate and lifespan (also in the area of the proposed introduction, if known).

10) Describe the known pathogens and parasites of the species or stock.

11) Describe the behavioural traits (social, territorial, aggressive).

D) Interaction With Native Species

1) What is the potential for survival and establishment of the non-native species if it escapes? (This question applies to species intended for aquaculture or for live rearing in a contained facility.)

2) What habitat(s) will the **introduced species** likely occupy in the proposed area of introduction and will this overlap with any vulnerable, threatened or endangered species? Indicate if the proposed area of introduction also includes contiguous waters).

3) With which native species will there be a niche overlap? Are there any unused ecological resources of which the species would take advantage?

4) What will the introduced species eat in the receiving environment?

5) Will this predation cause any adverse impacts on the receiving ecosystem?

6) Will the introduced species survive and successfully reproduce in the proposed area of introduction or will annual stocking be required? (This question applies to species not intended for aquaculture or life in a contained facility)

7) Will the introduced species hybridize with native species? Is local extinction of any native species or stocks possible as a result of the proposed introduction? Are there any possible effects of the introduced species on the spawning behaviour and spawning grounds of local species?

8) Are there any potential impacts on habitat or water quality as a result of the proposed introduction?

E) Receiving Environment and Contiguous Watershed

1) Provide physical information on the receiving environment and contiguous waterbodies such as seasonal water temperatures, salinity, and turbidity, dissolved oxygen, pH, nutrients and metals. Do those parameters match the tolerances/preferences of the species to be introduced, including conditions needed for reproduction.

2) List species composition (major aquatic vertebrates, invertebrates and plants) of the receiving waters. Are any of these species known to be susceptible to the diseases and parasites found to affect the introduced species in its native range?

3) Provide information on habitat in the area of introduction, including contiguous waters, and identify critical habitat. Which of those parameters match the tolerances/preferences of the species to be introduced? Can the introduced species disturb any of the habitats described?

4) Describe the natural or man-made barriers that should prevent the movement of the introduced organisms to adjacent waters.

F) Monitoring

1) Describe the plans for follow-up assessments of the proposed introduced species' success and how the negative impacts on native species and their habitats will be assessed.

G) Precautions and Management Plan

1) Describe the management plan for the proposed introduction or transfer. This should include but not be restricted to the following information:

a) details of the disease certification status of stock to be imported;

b) disease monitoring plan proposed for the introduced stocks following introduction or transfer;

c) precautions taken to ensure that no other species (**fellow travellers**) accompany the shipment;

d) who will be permitted to use the proposed species and under what terms and conditions;

e) will there be a pre-commercial phase for the proposed introduction or transfer;

f) description of the quality assurance plan for the proposal; and,

g) other legislative requirements that need to be met.

2) Describe the chemical, biophysical and management precautions being taken to prevent accidental escape of any fish, parasites and/or pathogens to and their establishment in non-target recipient ecosystems. Give details of the water source, effluent destination, any effluent treatment, proximity to storm sewers, predator control, site security, precautions to prevent escapes.

3) Describe contingency plans to be followed in the event of an unintentional, accidental or unauthorized liberation of the species from rearing and hatchery facilities or an accidental or unexpected expansion of the range.

4) If this proposal is intended to create a fishery, give details of fishery objective. Who would benefit from such a fishery? Give details of a management plan, and, if appropriate, include changes in the management plans for species which will be impacted.

H) Business Data

1) Provide the legal name of the owner and company, the aquaculture licence number and the business licence (if applicable) or the name of the government agency or department with a contact name, telephone, fax and email information.

2) Provide an indication as to the economic viability of the proposed project.

I) References

1) Provide a detailed bibliography of all references cited in the course of the preparation of the risk assessment.

2) Provide a list of names, including addresses, of scientific authorities and fisheries experts consulted.

Appendix VI: Draft Decision Support System For Site Selection of Atlantic Whitefish Introductions. (Numbers in brackets are cross-references to questions asked in Appendix III of the National Code.)

Background Information Requirements

Site Info

Site Name
[B6] Location (with map)
Size
Depth (max)
[E1] Temperature (max/min)
[E1] Salinity (max/min)
[E1] Turbidity
[E1] pH
[E1] Oxygen
[E1] Nutrients
[E1] Metals

Ecology/Habitat Information
[E2] Species composition [small-mouth bass? chain pickerel? Salmonids? Lake whitefish? / Atlantic whitefish? Federal SAR species? Provincial SAR species? Other?]
Pathogens or parasites present? If yes, explain...
Describe any imminent or likely threats of habitat destruction and/or contamination?
Describe any existing activities/impacts?
[E4] Barriers to escapement?
Likelihood of escapement? [high/medium/low]

Management Information
Population density of surrounding area? [# established dwellings]
Is the site a protected area?
Is the site within a controlled area (e.g. National Park)?
Is there a management agreement with the landowner?
Is the surrounding area already dedicated to other uses?
Is the site accessible by road?
Other accessibility issues? Explain...

Species Information
[B1] Common name
[B1] Scientific name
[B2] Distinguishing characteristics. Picture.
[C1] Natural range?
[C1] Present Range?
[C3] Limiting factors?
[C4] pH requirement [max/min]
[C4] Temp requirement [max/min]
[C4] Salinity requirement [max/min]
[C4] Oxygen preferences
[C5] Specific habitat requirements?
[C6] Reproductive behaviour [that would effect site selection]?

[C7] Migratory behavior [that would effect site selection, escapement, etc.]?
[C8] Food preferences/requirements?
[C9] Growth rate and lifespan?
[C10] History of pathogens and parasites of the species or stock?
[C11] Other behavioural traits? [social/anti-social/territorial/aggressive]
Predators?
COSEWIC status
SARA status

Source Stock Info
Source type [hatchery/wild]
[C8] Source location
[C8] Genetic stock (if known)
History of parasites?
History of disease?
Likelihood of fellow-travellers?
[G1a] Disease certification status.

Project Design
[B7] Numbers of organisms to be introduced? [initially, ultimately, timing]
[B7] Can project be broken into sub-components? If yes, explain...
Timeframe of introduction?
[D6] Frequency of stocking?
[B8] Stock source? [see source info above]
[F1] Describe any plans for follow-up assessment.
[G1b] Describe any disease monitoring plan.
[G1c] Describe precautions that will be taken to ensure no fellow-travelers.
[G2] Describe precautions that will be used to prevent escapement from target area.
[G3]Describe any contingency plans in case of escapement.

Assessment

Introduction
[B4] Objective of the proposed introduction? [recovery / survival]
Site Name
Species for Introduction [whitefish]
Source Stock
Project Design

Pre-Screening
Are there immediately apparent show-stoppers? [yes/no]
If yes, explain...

Risks to the Introduced Species (Atlantic Whitefish)
Habitat equivalence with present or former area of occupancy? [low/medium/high]

Factors influencing likelihood of survival
[E1] Suitable water quality? [yes/no]
Suitable food source? [yes/no]
Risk from predators? [yes/no]
Presence of non-native species? [e.g. chain pickerel]
Equivalent fish assemblages? [yes/no]
[E2] Suitable thermal regime? [yes/no]
Are there disease, parasites, or other health risks known to be present in the receiving environment? [yes/no]
Other survival risks? Explain...
Overall likelihood of survival in target area? [high/medium/low]

Factors influencing likelihood of establishment
Suitable spawning habitat? [yes/no]
Presence of other reproductive requirements? Explain...
[D6] Overall likelihood of establishment in target area? [high/medium/low]

Risks to the Receiving Environment
Risk to existing genetic diversity
[D7] If lake whitefish present, risk of hybridization? [high/medium/low]
[D7] If Atlantic whitefish present, risk of harmful genetic alteration? [high/medium/low]

Risk to existing species diversity
[D2] Overlap with other SAR species? [yes/no] [+/-]
[D2] Overlap with provincially protected species? [yes/no] [+/-]
[D2] Overlap with other species with conservation significance? [yes/no] [+/-]

Risk to existing community health and structure
[D8,E3] Risk to existing habitat (e.g. changes in water quality)? [high/medium/low]
If so, explain...
[[D3] Risk of competitive interaction? [high/medium/low]
If so, explain...
[D4,5] Risk to prey species? [high/medium/low]
If so, explain...
[E2] Risk of parasites, diseases and fellow-travelers to native stocks? [high/medium/low]
If so, explain...

Risks to Society
Are there socio-economic impediments? [yes/no] Explain...
Can the impediments be overcome? [yes/no]
Social consequences of whitefish presence? [high/medium/low]
Mitigation measures available? [yes/no]
Compensation measures available? [yes/no]
Removal of whitefish possible, if needed? [yes/no]
Public consultation conducted? [yes/no]
Community acceptance? [yes/no] Explain...

Management Considerations
Difficulty of implementation? [high/medium/low]
Difficulty of monitoring? [high/medium/low]
Cost? [high/medium/low]
Technical expertise available? [yes/no]
Likelihood of partnerships? [yes/no]
Likelihood of long-term commitment? [high/medium/low]
Consistent with other management priorities/policies? [yes/no]
Compliance with other legislative requirements? [yes/no]
Compliance with provincial legislation?
Section 73 authorization under SARA possible?
Section 56 authorization under Fisheries (General) Regulations possible?

Other Information Requirements of Appendix III – National Code
[A] Executive Summary
[B5] Alternate strategies considered and implications of doing nothing.
[G1g] Legislative requirements that need to be met.
[H1] Name and contact info of applicant.